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Farmer-Producer Organisations: Mapping Research Trends and Future Pathways- A Bibliometric Analysis

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Abstract

The farmers buy farm equipment, fertilizers, pesticides, seeds, and livestock at retail prices, sell the farm production wholesale, and pay the freight both ways. This is the only profession that depends on hope. The farmers' Cooperative was established to enhance market participation and reduce transaction costs through collective action to overcome the above predicament. Our research intends to find out the research gaps and evolution of thoughts, identify lead authors and institutions, identify key thematic areas, discover new frontiers in the researched area, and help policymakers develop roadmaps for the farmers. Farmer's Producer Organisations (FPO) is a new, emerging, and appealing agriculture area that has generated much attention from researchers, academicians, and policymakers. We adopted bibliometric analysis to explore the truth. This research paper aims to determine the volume of annual scientific productions, leading countries investigated in this direction, and also to figure out the critical determinants responsible for the growth of FPOs, easing them to formulate better plans and strategies for their smooth functioning. The author used bibliometric analysis and R open-access software to do the analysis. The research communities are all part of global scholars across different universities and countries. A total of 496 research works published between 2012 and 2023 were studied and retrieved from WoS using the search query "FPO", "FPC", "Trade and Pattern of FPO", and "Sustainability in Agriculture". This paper found that from 2012-2023, we found 496 resources and 1547 authors who studied in the field. The critical keywords in the FPO Study are "farmers" and "Collective action", and mostly USA tops in contributing to this field. We found the root and strong nexus where other researchers can connect to do impactful research. The authors identified four thematic areas to do further research.

Keywords: FPOs, bibliometric, Science Mapping, Sustainability, ICAR

1. Introduction

Agriculture is the primary source of livelihood in India. India has become the leading country in the agricultural sector and generates their livelihood source [1] [2]. Four hundred eighty-two million are employed in the agricultural sector; 44% and above are farmers, cultivating to feed the country, and the rest are landless labourers roaming to different cities (Figure 1) to earn their livelihood as labourers [13]. The employment rate in Financial Year 2023 is nearly 143 million people, a decline from 2022 [33]. About 85% of farmers are small, marginal and hold less than 2 acres of land and still, they are unable to magnify their scale of operation due to a myriad of reasons like untimely disbursement of credit, lack of storage facilities, logistics problems and lack of proper market linkage facilities [16] [4] [6] [12].

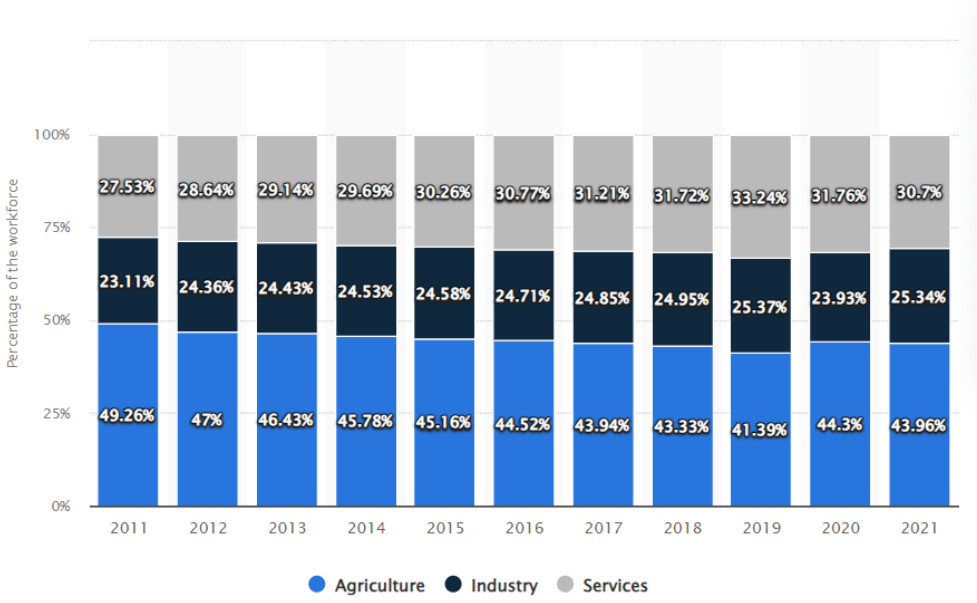

Figure 1:

Agricultural, Industry and service Sector growth rate. Source: Number of people employed across the agriculture sector in India from financial year 2011 to 2021. Statista, 2024

To overcome the above predicament, the farmers' Cooperative was established to enhance market participation and reduce transaction costs through collective action [22] [42]. With the flitting time, the Cooperative failed to solve the problem of small and marginal farmers. The critical weakness of the Cooperative was the abysmal governance structure [8]. In 2013, the govt. India reared up with the novel concepts of FPOs (Farmer producer organizations), new forms of farmers' collectives coming under the ambit of the Companies Act. These organizations are characterized by formal, autonomous, outward orientation and are regarded as a hybrid between private companies and cooperatives [39]. This emerging and appealing area of agriculture has generated much attention from researchers, academicians, and policymakers.

2. Objective

The main objective of FPOs is to ensure economic empowerment for smallholder farmers through backward and forward integration. It has addressed the problem confronted by small and marginal farmers needing to be better connected with market linkage; hence, the peasants do not fetch accurate prices for their produce. It eases the problem of small and marginal farmers, like economy of scale in purchasing inputs, and smoothen transport facilities and primary and secondary processing. Eventually, it reduces the cost of marketing and transportation [30] [26] [28] [04]. The enormity of FPOs study is increasing. The agriculture sector is dynamic and vital for a country; knowing where we have been is key to knowing where we need to go. Understanding past research is not just an academic exercise but a roadmap for action. ***The authors analyzed and accumulated previous literature on this sector to understand the research gaps that may support decision-makers in developing policy designs for farmers' well-being. This research will also help different stakeholders like NGOs, Agri-tech companies, and government agencies collaborate to benefit the community and provide more support.***

Previous Research on FPOs focused on major key themes like impact on income, livelihoods, and productivity; cooperative models and governance structures; and their role in empowering women and marginalized farmers. Other important areas of study involve how FPOs help link smallholders to modern markets and reduce transaction costs and their contributions to climate-smart agriculture, reducing food loss, and promoting sustainable agri-business models. A Few researchers have explored the influence of farm laws, policy impacts, and regulatory challenges, along with conducting comparative studies across countries like Kenya, Peru, and Ethiopia.

Table 1: Previous Research studies

Research themes	Authors
income, livelihoods, and productivity	Mukherjee A, Singh P, Ray M, SATYAPRIYA S, Burman RR; Ahmed AB, Qureshi SU, Nargis SH
cooperative models, organizational structures, and governance theories.	Borgström M; Watkins A, Papaioannou T, Mugwagwa J, Kale D; Michaud M, Audebrand LK
FPOs' role in empowering women and marginalized farmers.	Mukherjee AN, Singh P, Rakshit SH, Priya S, Burman RR, Shubha K, Sinha KA, Nikam; Mukherjee A, Singh P, Satyapriya S, Rakshit S, Burman RR, Shubha K, Kumar S;
Linking smallholders to modern markets and reducing transaction costs	Trebbin A; Fischer E, Qaim M.
Climate-smart agriculture, food loss, and sustainable agri-business models.	Villalba R, Joshi G, Daum T, Venus TE; Singh S, Kumar P.
farm laws, policy impact, and regulatory challenges.	Behera M ; Trebbin A; Watkins A, Papaioannou T, Mugwagwa J, Kale D; Sengupta S, Choudhary S, Obayi R, Nayak R; Bernard T, Spielman DJ ; Bikkina N, Turaga RM, Bhamoriya V; Markelova H, Meinzen-Dick R, Hellin J, Dohrn S
Comparative studies across countries (e.g., Kenya, Peru, Ethiopia)	Fischer E, Qaim M.

Source : Author's analysis

Current research on FPOs mainly focuses on India, with limited studies from other developing regions. Emerging technologies like AI, blockchain, and digitization in FPO governance are rarely explored, and topics such as rural youth engagement and behavioural aspects like trust and leadership are under represented. These gaps align with the themes of Agricultural Innovation Systems and Farmer's Empowerment, especially in terms of technology use and youth inclusion. There is also a lack of empirical studies on microfinance, insurance, and credit access, as well as limited evidence on the real impact of FPOs on farmer income and well-being. The real impact of FPOs on smallholder income and broader socio-economic well-being is also not well documented. These research gaps are closely linked to the themes of Membership Benefits, Farmer Challenges, and Farmer's Empowerment. New areas like end-to-end digitization, cold storage, logistics, and economies of scale in procurement and marketing remain under-researched. These gaps align with the core themes of agricultural innovation, farmer challenges, and empowerment.

The authors addressed these Research questions in multiple ways. The objective of this research is to posit a bibliometric structure and Intellectual in the "FPOs" research field (RQ1). This paper also aims to highlight the volume of scientific research productions on "how, who, what, where, and how" FPO was investigated (RQ2) and what were the major findings. The author will also explore different clusters in FPOs to recommend the decision-making agencies (RQ3). Many empirical studies on farmer-producer organizations have been conducted

worldwide, but very few studies have focused on the bibliometric part of the FPOs. This opens an excellent opportunity for researchers, policymakers and other stakeholders to conduct a bibliometric study on FPOs so that we can figure out the critical determinant responsible for the growth of FPOs, easing them to formulate better plans and strategies for their smooth functioning in future.

RQ1: What are the Publication trends in FPOs?

RQ2: What are the scientific productions investigated in FPOs?

RQ3: What are the emerging thematic areas in FPOs?

3. Background Of The Study

Farmer Producer Organisation(FPOs) differ slightly from cooperatives because they enjoy legal provisions for sharing profit in the form of dividends. The main objective behind forming FPOs is to enhance farmers' competitiveness so they can tap into market opportunities easily. The primary operations of FPOs entail procurement of inputs, market linkage, [45] triggers networking, and facilitating finance processing, maintaining quality control and catering training and technical advice. Due to continuous fiasco in the operation of cooperatives in India, there is an exigency for a new framework of cooperatives called producer companies that can provide handholding support to smallholder farmers [32]. The FPOs follow the regulatory framework of companies, which is very distinct from that of cooperatives co-operatives [35]. In India, the dept. Agriculture Cooperation and Farmer Welfare is the nodal agency for the growth and development of FPOs in India. For the smooth functioning of FPOs, the government of India (GOI) has entrusted the operation task to many Govt. institutions like SFAC, NAFED, and FCI and NABARD. It is a new form of collectives and has a well-embraced model worldwide. It is a membership-based organization with elected leaders accountable to their constituents [19], and it has the hybrid framework of private and cooperative societies [40]. GOI acknowledges 2014 as the "FPO year" [43]. The Ministry of Agriculture's DAC and FW has made a noteworthy step in support of and fortification of farmer member-based institutions. Notably, these FPOs serve as preferred implementation agents for a range of agricultural development initiatives for the Indian federal and state governments. For example, SFAC has shared information about training requirements, research, knowledge management, and innovative approaches to investments, markets, and technology. Additionally, from the beginning of FPO to the end of their existence, SFAC worked in partnership with NABARD and other organizations to support capacity-building initiatives. Few attempts have been successful in supporting FPOs at any level, despite the numerous attempts that have been undertaken. Because most FPOs are limited to consolidation and aggregation activities, their growth is impeded [37].

According to the literature available, the reasons why FPOs struggle to gain traction are:
- they lack a clear understanding of the value chain;
- they have limited business skills within the POs;
- their organization model is not replicable;
- they are generally uncertain about the expected benefits;
- and they have a hazy understanding of the cost and margin along the value chain.

Therefore, to establish and promote the idea of FPOs as a component of the income security of the agricultural community, it is imperative that all stakeholders—including government officials, farmers, private firms, financial institutions, bankers, academicians, researchers, and others—get in sync (Singh, S., & Kumar, P. , 2022).

4. Methods

Bibliometric analysis becomes essential for better understanding the development of various concepts and the body of empirical research on FPOs. Within this, science mapping is a key tool to visualize and analyze thematic evolution and knowledge structures. The bibliometric reviews were performed to glean information related to its concept/trends [11], publications from all around the world and information about different authors, journals, and publishers together with their years, citation counts, and effects [23]. Additionally, it discloses the study methods

that the author used. It offers an in-depth understanding of the topic. The bibliometric study also assists researchers in finding out the important variable in the study, resulting in the gap in the study [10].

4.1 Data Extraction and Filtration Process

The work that was published as an article in journals served as the foundation for the analysis which includes all types of research endeavors, including theoretical and conceptual publications as well as empirical work. A large percentage of citation studies conducted globally have used Web of Science (WoS), which is made up of the three ISI citation databases (Arts and Humanities Citation Index, Science Citation Index, and Social Sciences Citation Index [3], [24],[29].

The study entails research papers published from the years 2012 to 2023. A bibliometric analysis of papers was the main objective of the papers. The paper was retrieved from the WOS repository (Web of Science). The different permutations and combinations of keywords were used to search the papers (i.e. “FPO”, “FPC”, “Trade and Pattern of FPO”, and “Sustainability in Agriculture”). After refining the search of all the downloaded papers, 496 papers were left for analysis. The author used the Bibiloshiny tool of R Software and cleaned the data for multiple entries before running the analysis.

Note : This study considers literature published between 2012 and 2023. Studies from 2022 were decreased significantly. The year 2024 was not included because many 2024 studies were not thoroughly indexed in bibliometric databases, ensuring our dataset remains consistent, comprehensive, and replicable.

5. Results

5.1 About the Database

Analysis of 496 documents, primarily from the journal Studis (89%), from 228 sources, shows a steady research output. The references' average citations per document (10.91) indicate a strong research base. The Keyword analysis shows conceptual diversity, with 1,640 author keywords and 936 Keywords Plus, pointing to significant growth of FPO research. The authorship patterns reveal that single-author (average 3.1) works are rare compared to collaborative research (3.45). The FPO research is growing and needs more in-depth research and stronger international collaboration.

Table 2: Key details of extracted documents by WOS (Web of Science)

Description	Results
MAIN DATA	
Time Span	2012:2023
Sources (Journals, Books, etc)	228
Documents	496
Average years from publication	5.1
Average citations per documents	10.91
Average citations per year per doc	1.672
References	21552
DOCUMENT TYPES	
article	446
article; early access	14
article; proceedings paper	3
article; retracted publication	1

editorial material	4
review	28
DOCUMENT CONTENTS	
Keywords Plus (ID)	936
Author's Keywords (DE)	1640
AUTHORS	
Authors	1547
Author Appearances	1704
Authors of single-authored documents	67
Authors of multi-authored documents	1480
AUTHORS COLLABORATION	
Single-authored documents	67
Documents per Author	0.321
Authors per Document	3.12
Co-Authors per Documents	3.44
Collaboration Index	3.45

Source: Generated using Biblioshiny

5.2 Annual Scientific Production

The annual scientific production on the "FPOs" (Farmer Producer Organizations) theme from 2012 to 2023, as shown in Figure 2, reveals a distinct upward trend beginning in 2016, with a significant peak in publication activity between 2016 and 2021. Notably, 2020 and 2021 recorded the highest number of publications, with 72 and 74 documents, respectively. This surge reflects increased academic and policy interest in FPOs during that period, which policy reforms may drive. The sharp decline in FPO-related publications in 2022, dropping to 44 papers and continuing downward, may reflect broader academic disruptions. During the COVID-19 crisis, research focused heavily on pandemic-related topics, ignoring other research areas [2]—requiring longer timelines such as FPO. Open Access Publishing platforms like MDPI, Frontiers, Hindawi saw a decreasing publishing pattern because of the removal of a few journals from the WoS database and with higher APC charged by these journals [31].

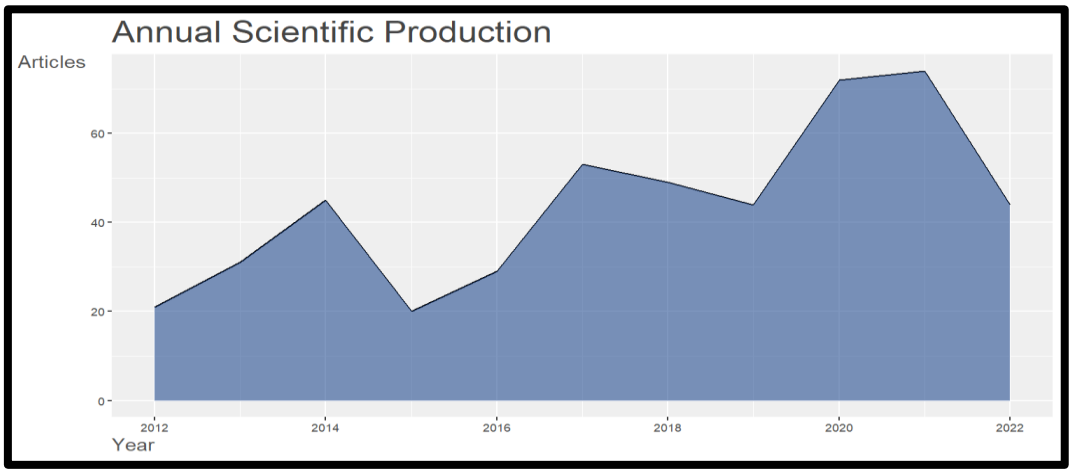

Figure 2: Annual Scientific Production. Source: Generated using Biblioshiny

5.3 Top – Authors Production over the Time

The analysis shows that the author Bijman J was consistent with his research from 2012 to 2022, while contributions to FPO research are distributed across multiple authors; only a few (e.g., Yegbemey RN, Boskova I, D'Haese D'Haese M, Moustier P) demonstrate consistent productivity and impact over time. Peaks in 2018–2021 reflect collaborative momentum, but overall engagement has been sporadic, indicating a fragmented yet evolving research community.

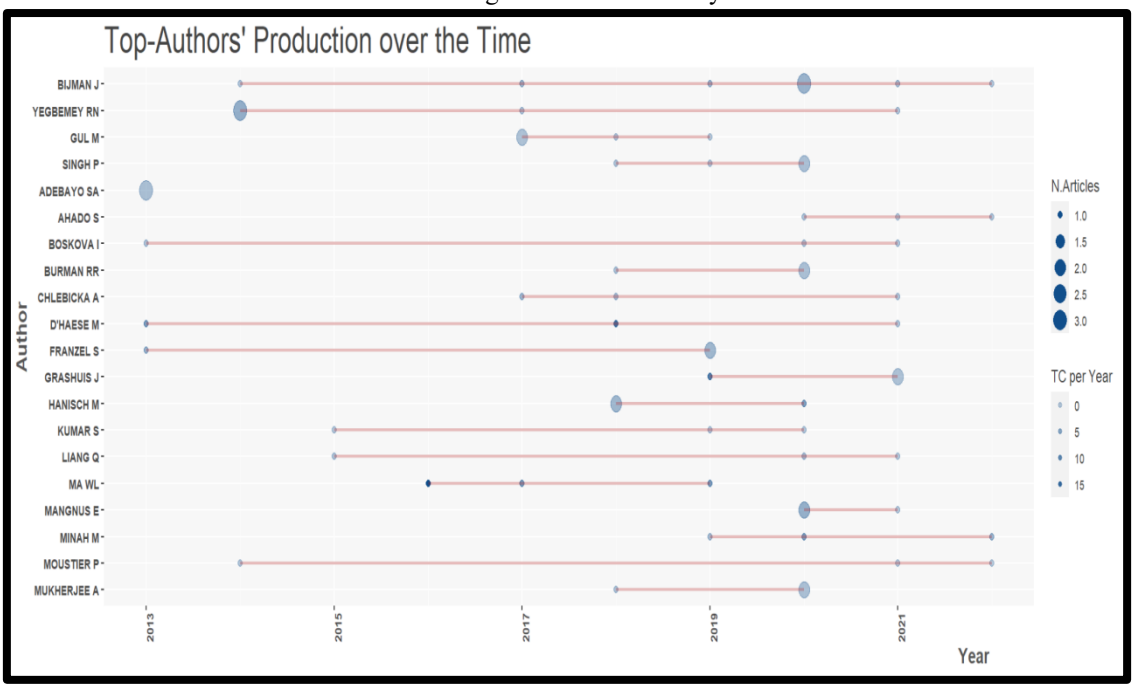

Figure 3: Top – Authors Production over the Time. Source: Generated using Biblioshiny

5.4 Most Cited Countries and Global Cited Documents

From Table (3) and Figure (4), The global research citation (Total citations & Average Article citations) landscape highlights a classic trade-off between quantity and quality—while the USA and Germany gain visibility through sheer research volume, emerging countries like Nigeria, Belgium, and the UK achieve disproportionate impact with fewer but higher-quality contributions. India's rising research output tells a story of growth, yet its limited international collaborations lag behind per-article visibility.

Table 3: Country Citations

Country	Total Citations	Average Article Citations
USA	814	11.629
GERMANY	666	24.667
NETHERLANDS	382	15.917
UNITED KINGDOM	368	28.308
ITALY	280	14.737
CHINA	271	10.84
CANADA	259	19.923
NIGERIA	192	48

SOUTH AFRICA	185	18.5
FRANCE	172	6.37
AUSTRALIA	167	15.182
BELGIUM	148	37
AUSTRIA	113	12.556
SWITZERLAND	110	15.714
MALAYSIA	94	94
GHANA	80	13.333
INDIA	73	2.147
DENMARK	64	21.333
SPAIN	59	7.375
POLAND	57	9.5

Source: Generated using Biblioshiny

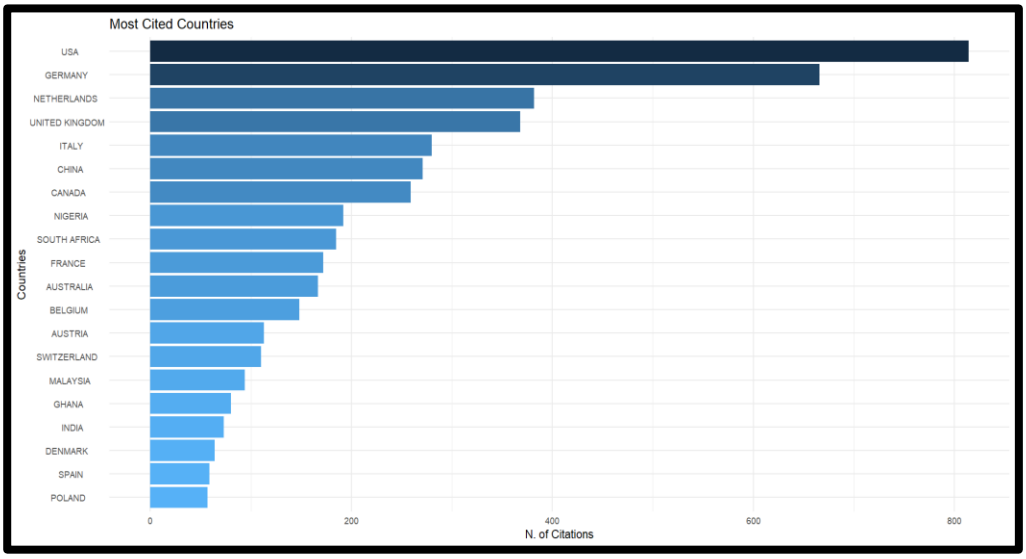

Figure 4: Most Cited Countries. Source: Generated using Biblioshiny

5.5 Most cited documents & Factorial Map

Figure (5 & 6) The factorial map of the most influential documents reveals three distinct clusters that together illustrate the intellectual structure of the field. Cluster one (red) is centred around work in sustainability, Public cooperative economics, and world development, highlighting the socio-economic dimensions of agricultural and food systems research. Contributions addressing food policy, rural development, and institutional frameworks indicate a considerable focus on structural and policy interventions, indicating that Cluster two (blue) is more bent towards policy and governance. With a focus on horticulture, agriculture, and ecological economics, cluster three (green) suggests more ecological and technical methods of transforming the food system. Interestingly, research papers from authors like Kornelinck (2019), Minah (2019), and Dhakai D (2021) that are located close to the centre of the map serve as conceptual bridges, fusing topics from all of the clusters.

In contrast, Sekabira (2022) and Liu (2019) provide more generic approaches that indicate emerging or specialised directions that may represent the future trajectory of the field. As this factorial distribution shows,

the three main but related lines of academic investigation are sustainability, governance, and ecological approaches. The study landscape is multifaceted and dynamic.

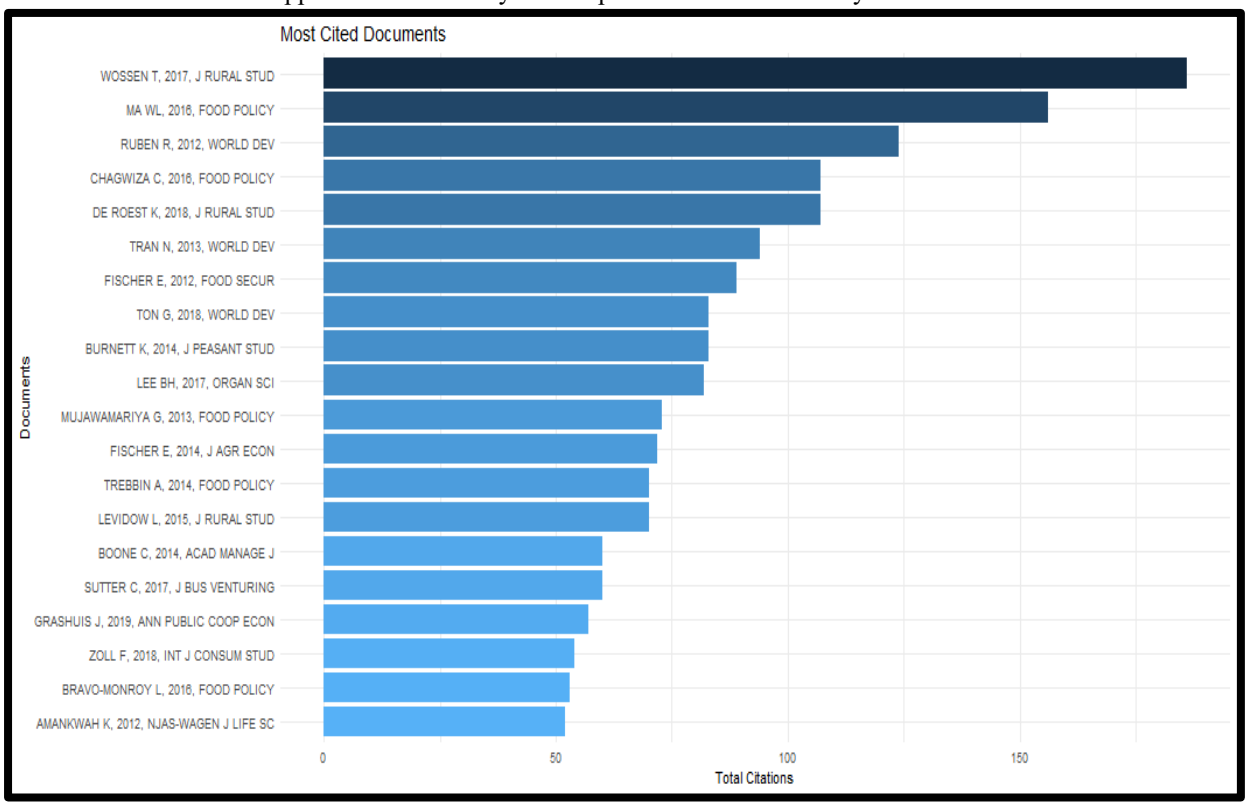

Figure 5:Most Cited Documents. Source: Generated using Biblioshiny

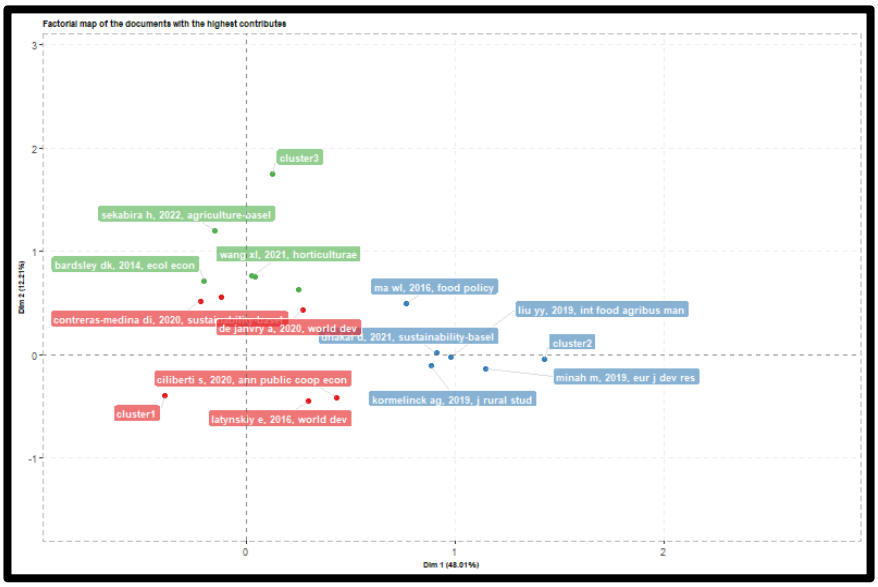

Figure 6:Factorial Map of the Documents. Source: Generated using Biblioshiny

5.6 Sankey Diagramme

A Sankey diagram (Figure 7) is a flow diagram where the arrow widths correspond to the flow quantity. Nodes are the connected objects, while links are the connections between them [20]. In this graph, we are trying to find the link among countries, prominent keyword plus and sources. The diagram below shows that it is very evident that the USA is the frontrunner in publishing research papers on the “FPOs” theme in leading research journals.

According to their precedence, the prominent keywords used in the research papers are farmers, management, collective action, farmers and producer organization. In the case of India and the Netherlands, the most prominent keywords are collective action. The journal which attracted the high-quality works on “FPOs” is the Journal of Rural Studies, Food Policy and sustainability. In the case of India, the only Indian journal that embraces quality papers is the Indian Journal of Agricultural Sciences. Countries that have made minuscule contributions towards this theme are Benin, Spain, Australia, and Turkey. The keywords that have received less attention are system, sustainable, smallholders, and governance, and they can probably create more avenues for future research. The onus is for future researchers to initiate systems, sustainability, smallholders and governance research.

The Sankey diagram corroborates the growing themes in Agricultural Innovation Systems and Farmer Empowerment, particularly concerning technology utilization and youth inclusion which aligns with our future research themes. This implies that more research is required to examine how FPOs function within larger agri-systems, evaluate governance mechanisms, and gauge their inclusive effects specifically in countries like india where impact assesment studies on FPOs are very limited. These gaps inform and strengthen the conceptual foundations used in this manuscript.

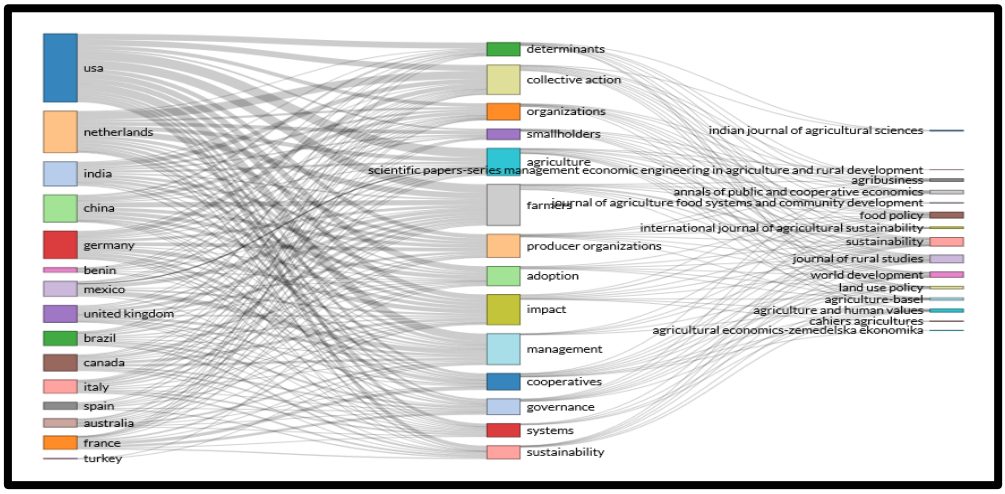

Figure 7:

Three plot diagramme. Source: Generated using Biblioshiny

5.7 Renowned Authors on FPO

Table 4 highlights a classic quantity vs. quality trade-off. Some authors achieve wide recognition with very few but impactful publications. Researcher MA WL has a three-h index and the highest 0.375 m index, while other researchers BIJMAN J, YEGBEMEY RN sustain moderate but steady visibility through consistent output.

The developing interest of scholars with a higher m-index is associated with a dynamic research field, with researchers moving from one field to another. Furthermore, the unequal distribution of citations indicates that most contributions serve as supporting evidence, while a few prominent publications influence the field's intellectual structure.

Table 4: Renowned authors and their index.

Author	h_ind	g_ind	m_ind	TC	NP	PY-start
BIJMAN J	4	7	0.4	54	8	2014
YEGBEMEY RN	4	5	0.4	45	5	2014
GUL M	2	2	0.286	7	4	2017
KUMAR S	1	1		4	4	2015

SINGH P	2	3	0.333	11	4	2018
ADEBAYO SA	2	3	0.182	13	3	2013
AHADO S	1	2	0.25	4	3	2020
ASHOK A	2	2		5	3	2019
BOSKOVA I	2	3	0.182	12	3	2013
BURMAN RR	2	3	0.333	9	3	2018
CHLEBICKA A	2	3	0.286	30	3	2017
D'HAESE M	2	3	0.182	157	3	2013
FRANZEL S	3	3	0.273	49	3	2013
GRASHUIS J	1	3	0.2	59	3	2019
HANISCH M	3	3	0.5	39	3	2018
LIANG Q	2	3	0.222	15	3	2015
MA WL	3	3	0.375	240	3	2016
MANGNUS E	2	3	0.5	14	3	2020
MINAH M	3	3	0.6	39	3	2019
MOUSTIER P	1	1	0.1	2	3	2014

Source: Generated using Biblioshiny

5.8 Most relevant Affiliation and relevant Words

From Figure (8), the leading university in publishing research articles on "FPOs" is Wageningen University, which has published 25 articles, followed by the University of Florida, which has published 17 articles. The only reputed and renowned institute of India, ICAR (Indian Council of Agricultural Research), has contributed seven articles on this theme. Unlike foreign universities, we lag far behind in the quantity and quality of the publications.

Figure (9) depicts the most relevant words in research articles were farmers, collective action, imp, act and agriculture. The other relevant words are cooperative and governance, which also play a vital role in the functioning of FPOs. Words like sustainability and markets are less prominent because they are not addressed in research publications. Hence, conducting more studies on sustainability and markets and how they influence the efficacy of FPOs functioning is imperative.

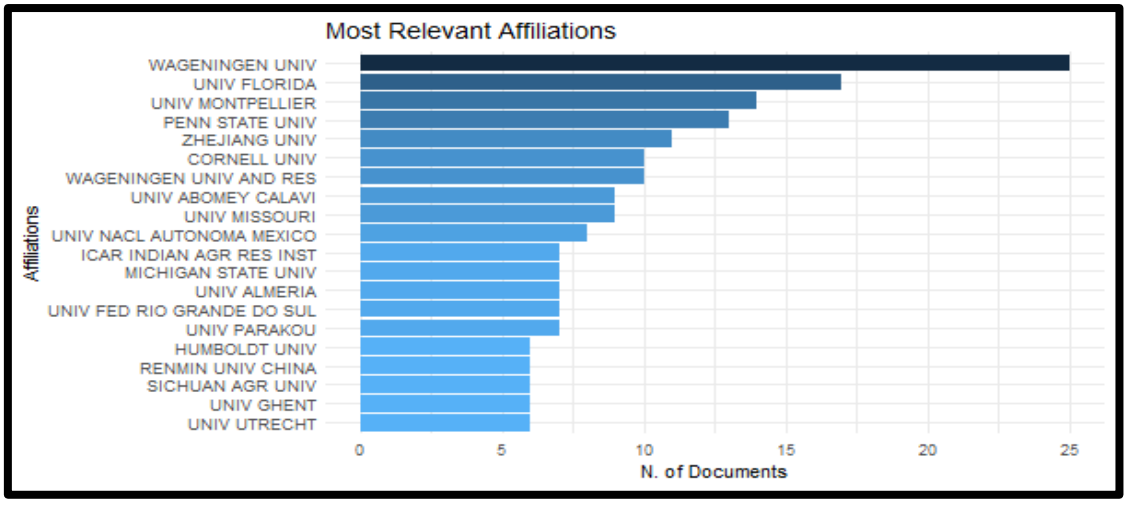

Figure 8: Relevant Affiliation.Source: Generated using Biblioshiny

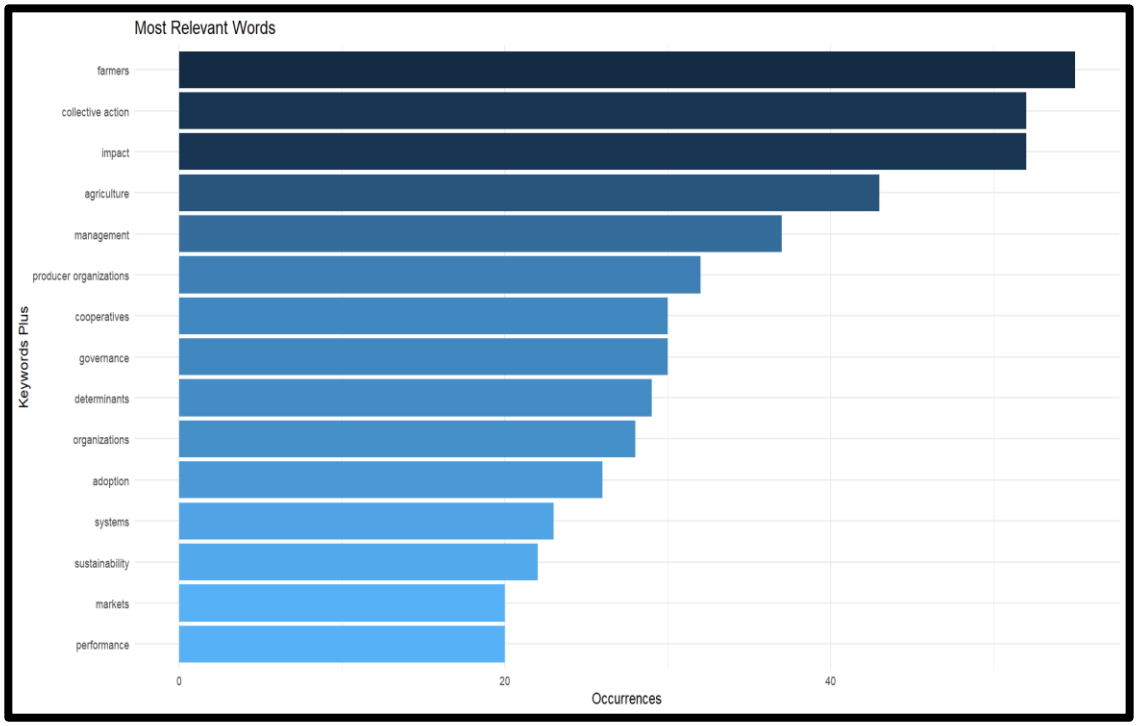

Figure 9: Most Relevant Words. Source: Generated using Biblioshiny

5.9 Collaboration and country of authors along with Author's country and country scientific production

Collaboration between countries has been presented as a percentage of country publication (SCP) and multiple-country production (MCP). The SCP and MCP (Figure 10) denote intra-country and inter-country publications [38]. From Table 5 and Figure 8, we can excavate much vital information. The USA secured the first Rank in SCP and MCP. At the same time, India has the highest publication as SCP but only two publications as MCP. The MCP ratio of India is .0588, connoting that India performed egregiously in collaborating with different countries. The other countries performed equally well in MCP, and Germany followed France, China and the Netherlands. It is exciting to note that Switzerland and Austria have the highest MCP ratios, i.e. .8571 and .7771, among all the countries. Figure 10a represents the country-wise analysis. The darkest means highly productive, and the lightest means least productive. The western side of the map is more agile on the theme "FPOs". The western part seems more briskly engaged in the total production of research articles. Countries that work more collaboratively tend to create more funding opportunities and open new avenues for writing impactful papers, adding impetus to research activities.

Table 5: Countries and Collaboration Index

Country	Articles	Freq	SCP	MCP	MCP_Ratio
USA	70	0.14257	55	15	0.2143
INDIA	34	0.06925	32	2	0.0588
FRANCE	27	0.05499	11	16	0.5926
GERMANY	27	0.05499	19	8	0.2963
CHINA	25	0.05092	12	13	0.52
NETHERLANDS	24	0.04888	11	13	0.5417
BRAZIL	21	0.04277	17	4	0.1905
ITALY	19	0.0387	15	4	0.2105

CANADA	13	0.02648	11	2	0.1538
TURKEY	13	0.02648	13	0	0
UNITED KINGDOM	13	0.02648	6	7	0.5385
AUSTRALIA	11	0.0224	8	3	0.2727
MEXICO	11	0.0224	9	2	0.1818
SOUTH AFRICA	10	0.02037	9	1	0.1
AUSTRIA	9	0.01833	2	7	0.7778
BENIN	9	0.01833	5	4	0.4444
SPAIN	8	0.01629	5	3	0.375
ETHIOPIA	7	0.01426	6	1	0.1429
SWITZERLAND	7	0.01426	1	6	0.8571
COLOMBIA	6	0.01222	4	2	0.3333

Source: Generated using Biblioshiny

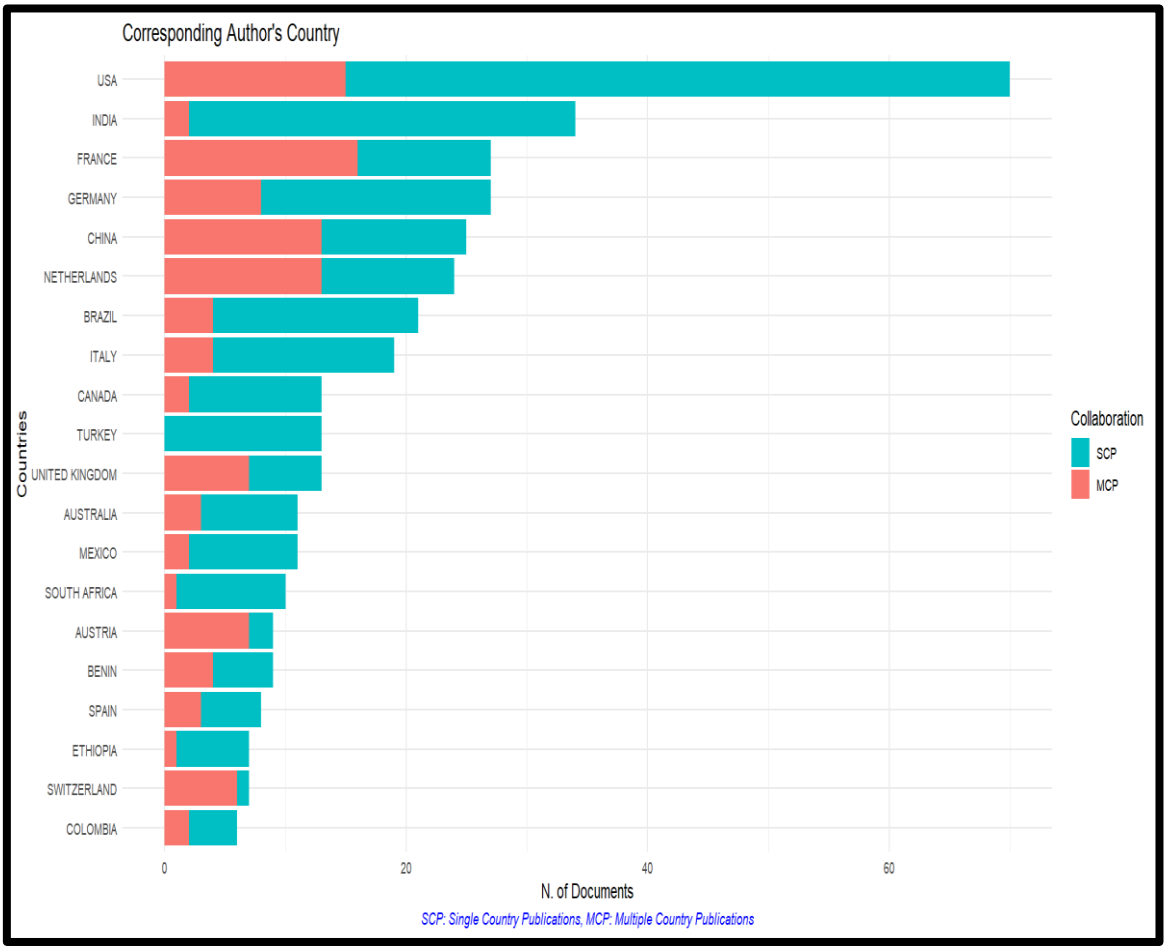

Figure 10: Corresponding Author's country. Source: Generated using Biblioshiny

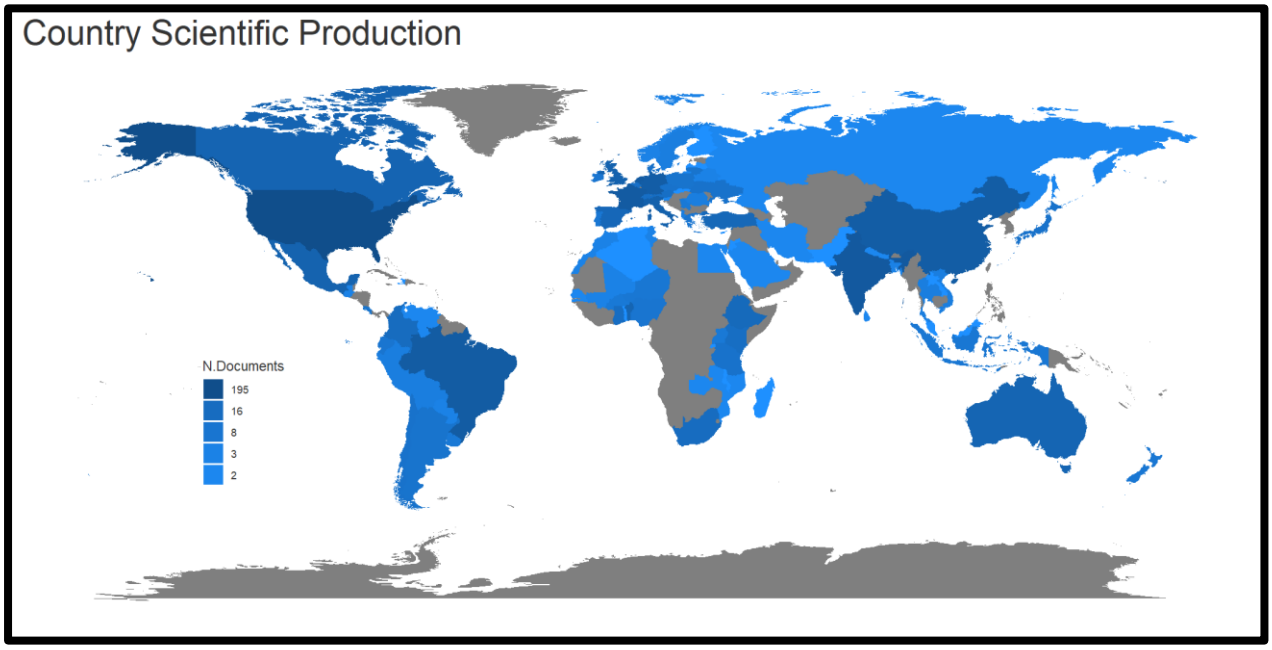

Figure 10(a): Country Collaboration Map. Source: Generated using Biblioshiny

5.10 Keyword Analysis

The keywords used to identify the pertinent previous words in our study area are very useful in searching documents in any database. This information aids future researchers in identifying the over-researched topics, under-researched keywords and trending keywords. From Table 6 and Figure 10(b), it is interesting to note that farmers, collective action and agriculture and management are the keywords most used in the "FPOs" theme. The less used or under-researched keywords are certification, standard, food, quality, and market.

Table 6: Keywords frequency.

Sl.No.	Terms	Frequency
1	farmers	55
2	collective action	52
3	impact	52
4	agriculture	43
5	management	37
6	producer organizations	32
7	cooperatives	30
8	governance	30
9	determinants	29
10	organizations	28
11	adoption	26
12	systems	23
13	sustainability	22

14	markets	20
15	performance	20
16	smallholders	20
17	agricultural cooperatives	19
18	fair trade	19
19	institutions	19
20	certification	18
21	participation	18
22	standards	18
23	food	17
24	quality	17
25	market	16

Source: Generated using Biblioshiny

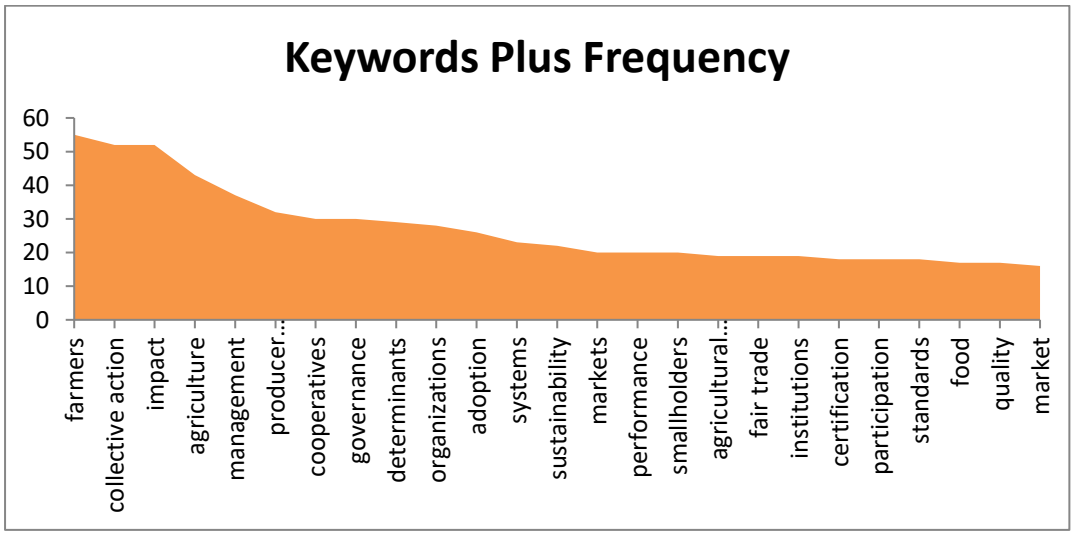

Figure 10(b): Keywords Frequency Area plot Chart. Source: Generated using Biblioshiny

5.11 Word Growth and Trend Topics

Figure 11 depicts the word growth spanning from 2012 to 2022. The relevance of words is enhanced with the passing years. Its use increases phenomenally with the time it takes to publish. The words are farmers, collective action, impact, and agriculture clearly represented in the figure below. Certain words like management, cooperative, and governance are very under-researched in most studies. However, with the passing years, the researchers realized its importance in contemporary research; hence, these words started to gain momentum after 2019. However, its growth rate could be more active than previous words.

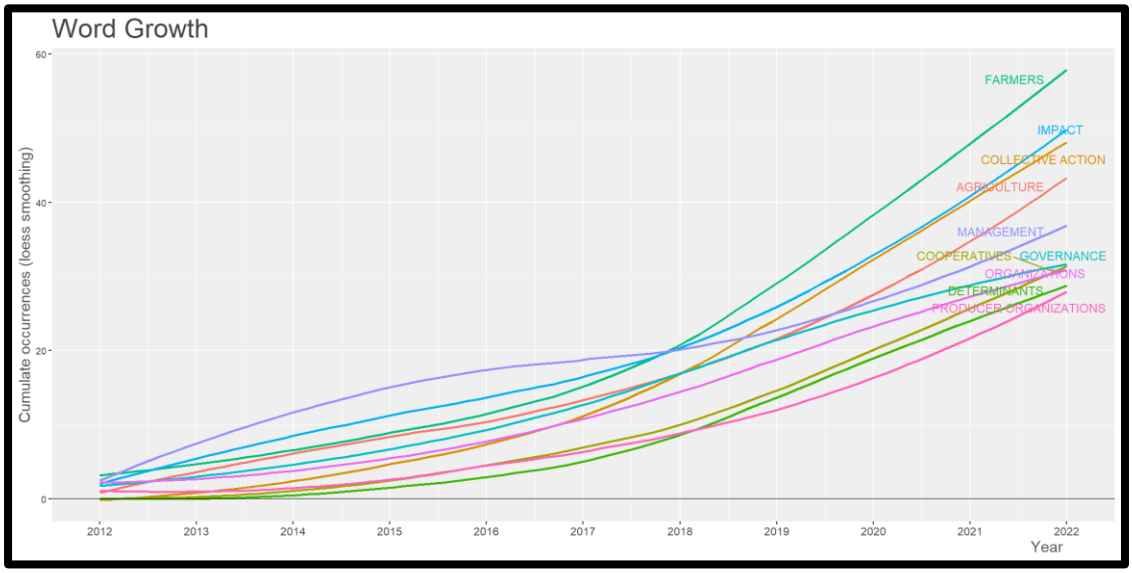

Figure 11: Word Growth. Source: Generated using Biblioshiny

Figure 12 revealed the trending topics in the "FPOs" theme and how these patterns changed within ten years from 2012 to 2022. From 2014 to 2016, the topics discussed were policy framework, system, climate change, and conservation. From 2016 to 2018, the trending topics were efficiency, trade perspective, consumption, and governance. From 2018 to 2020, the trend shifted to market participation, innovation, adaption, poverty and organization. Beyond 2020, the salient trend topics are sustainability, strategies, market framework, and the attitude of smallholder farmers towards FPO. These trending topics suggest ongoing contemporary research and consonance with the market dynamics. Another reason is that the current trending topics also open opportunities for funding activities.

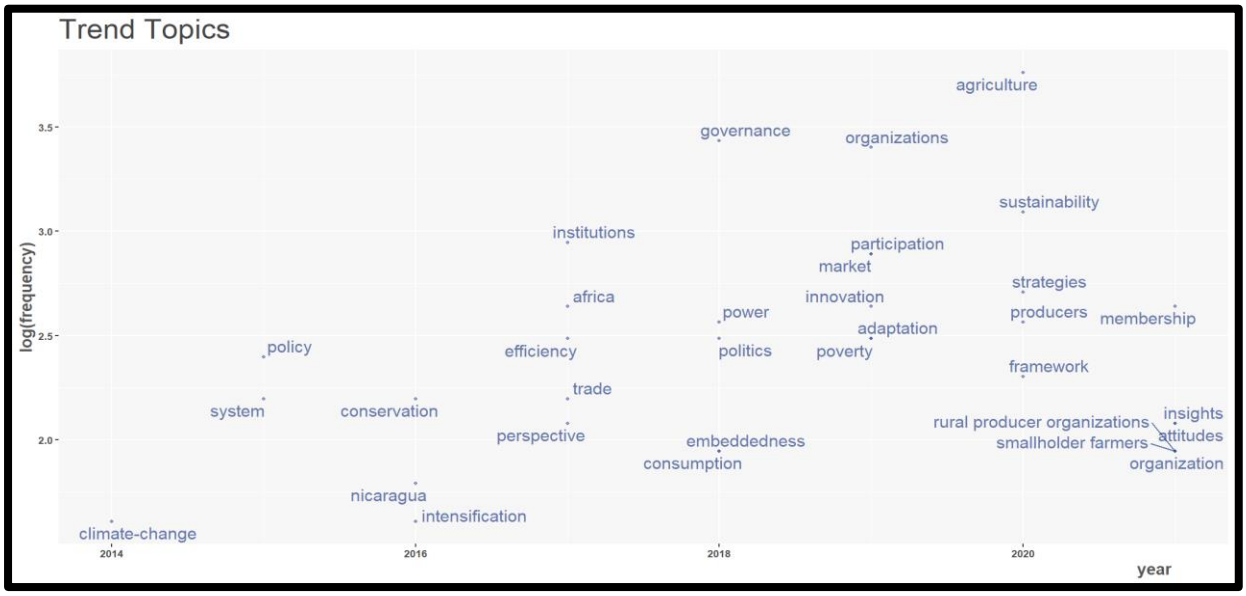

Figure 12: Trend Topics. Source: Generated using Biblioshiny

5.12 Sources Coupling

Figure 13 depicts the coupling map based on the sources. It is conspicuous from the figure below that bigger circles denote the journal's maximum number of couplings due to its higher number of citations or vice versa. The Journal of World Development, agribusiness in Developing and Emerging Economies and Food Policy has

the highest no. of citations globally. On the contrary, the Journal of Land Use, agriculture and Food Economics and Review of Development Economics have fewer citations globally. Hence, such journals could be more impactful. Business Strategy and Environment, Agriculture System and Peasant Studies are journals that have acquired central positions and are very low-impact journals.

Top-right journals are "power hubs," bottom-right are "network connectors," and bottom-left are "niche contributors."

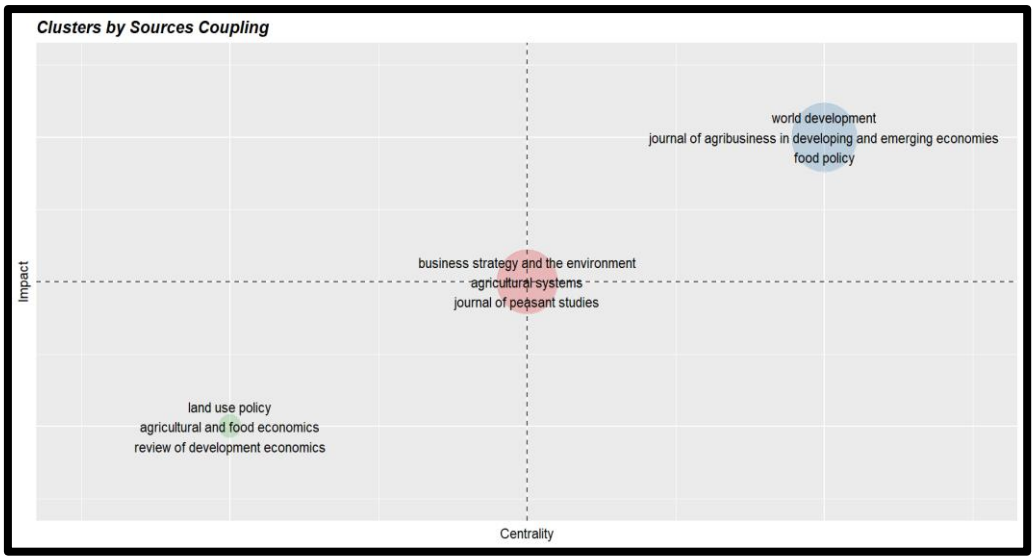

Figure 13: Cluster by Sources Coupling. Source: Generated using Biblioshiny

5.13 Thematic Map and Cluster analysis

Figure 14 depicts the thematic map where the most relevant theme from 2012 to 2022 is represented. The larger the circles, the more critical the themes. The most important themes are collective actions, farmers, and agriculture because most studies on “FPOs” encompassed the above themes. Agriculture and farmers are the primary themes, and many studies have been done on this. The niche theme (Table 6 & 6a) is systems because it is emerging, and many research studies are still being carried out on this theme. The most declining theme is governance, and the plausible reason is that it is poorly developed and marginal, which needs research intervention which aligns with our current future themes.

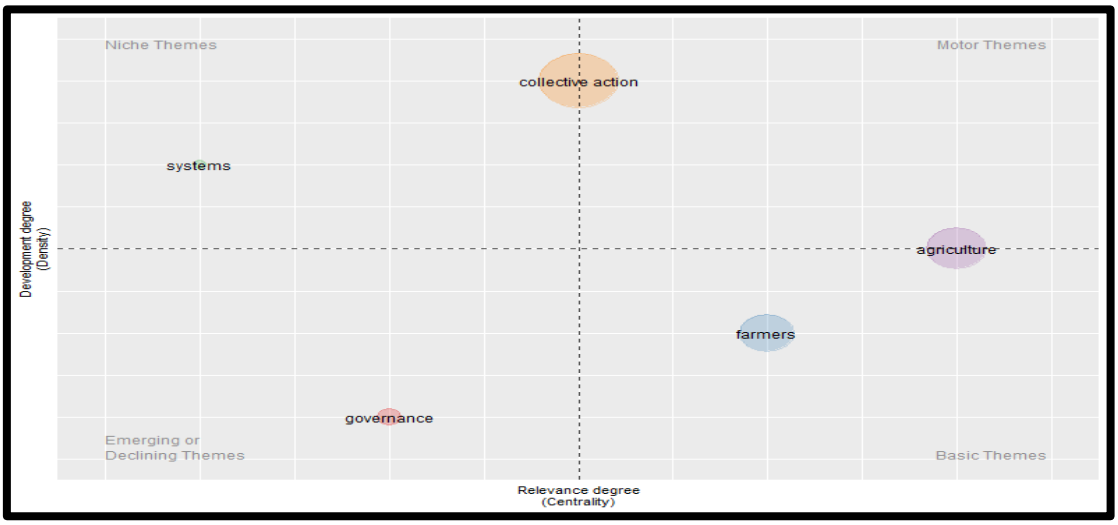

Figure 14:Thematic analysis. Source: Generated using Biblioshiny

This segment proposes significant information for future research. Table (7) and Figure show the five vital clusters.

CLUSTER 1	CLUSTER 2	CLUSTER 3	CLUSTER 4	CLUSTER 5
Standard	System	adoption	Agriculture cooperative	Markets
Certification	Management	determinants	Collective Action	Institution
quality	Agriculture	Performance	Participation	Organization
sustainability	food		Producer Organization	Impact
Markets			Smallholders	Cooperatives
Farmers				
fair Trade				
Governance				

Source: Generated using Biblioshiny

Table – 7(a) : Cluster table

CLUSTER 1	CLUSTER 2	CLUSTER 3	CLUSTER 4	CLUSTER 5
impact	cooperatives	farmers	collective action	perspective
markets	governance	agriculture	producer organizations	consumption
fair trade	organizations	management	determinants	embeddedness
certification	institutions	adoption	performance	scale
producers	standards	systems	smallholders	globalization
productivity	quality	sustainability	agricultural cooperatives	alternative food networks
	strategies	food	participation	consumers
	power	market	membership	economy
	future	networks	impacts	agro forestry
	policy	innovation	technology adoption	
		food security	efficiency	
		adaptation	market access	
		politics	poverty	

		risk	smallholder farmers	
		knowledge		
		framework		
		information		
		model		

Source: Generated using Biblioshiny

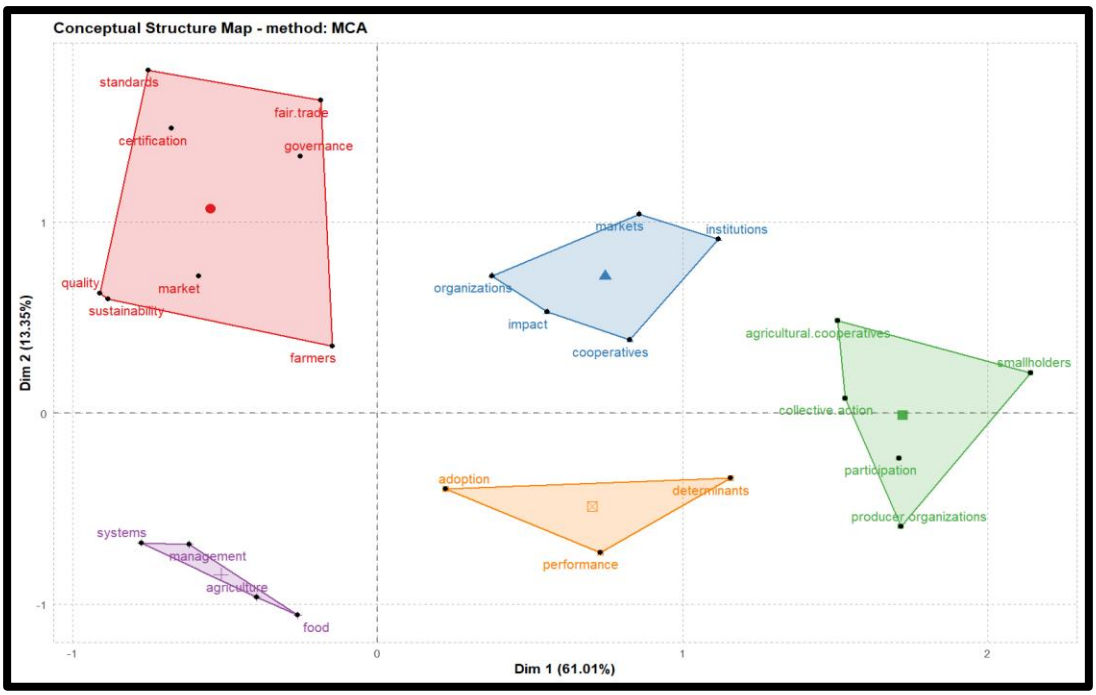

Figure 16: Cluster analysis. Source: Generated using Biblioshiny

6. Discussion

This paper's bibliometric analysis will help the FPOs understand the upcoming thematic areas and make decisions for solving the current challenges, notably to come up with full-fledged solutions.

6.1 Future Research Themes

The emerging themes identified in the study align well with the three research questions posed. For RQ1, which examines publication trends in FPOs, the themes of FPO and Agricultural Innovation Systems and FPO and Farmer's Empowerment are relevant, as they reflect the evolving focus on technology adoption and inclusivity in research. RQ2, which explores the nature of scientific productions in this domain, aligns closely with the themes of FPO and its Membership Benefits, FPO and Farmer's Challenges, and FPO and Farmer's Empowerment, highlighting the diversity of research—from financial mechanisms and infrastructure issues to socio-economic and behavioural aspects. RQ3 examines emerging thematic areas, reflecting the increasing focus on Agricultural Innovation Systems, infrastructure challenges related to Farmer's Challenges, and the integration of sustainability and rural youth within Farmer's Empowerment. This alignment ensures that the thematic structure of the analysis is grounded in the research objectives.

6.1.1 FPO and its Membership Benefits

When we explored the research further with the keywords "impact, markets, fair trade, certification, producer's productivity, and FPO", we found a limited number of work in this area. We received 1390 results, and during the

year 2024, only twenty-five research articles were published. We have identified selected journals to explore the identified clusters. A limited number of studies were conducted on Indian Farmers and the challenges they faced if not part of any FPOs. Most farmers across the globe, especially in India, are not well educated and are not receiving the direct benefits of different government schemes. However, when they become part of any FPOs, there is a significant effect on the quantity produced, the adoption of modern farming technologies, technical expertise [7] [9], more Selling and more earning privilege, and more market access [7], the price received from different agencies [14]. Indian Government also promotes FPO growth as an alternative to cooperative societies [7],[25]. Farmers may also be entitled to financial services, the procurement of farming products, the support of product packaging to attract more buyers, and crop insurance during production [7] and increase the livelihood of the farmers[39].

6.1.2 FPO and Farmer's Challenges

When We explored the research further with the keywords "cooperatives; governance; organizations; institutions; standards; quality; strategies; power; future policy and FPO", we explored 1980 decent results, and during the year 2024, only thirty-eight research articles were published. This also is an area where more research is required. Small farmers have faced challenges since Independence; however, the number of people dependent on their livelihood is a significant opportunity for policymakers to find suitable options for the Annadatas. The FPOs are the connecting bridges for these small farmers who, in return, receive benefits from different government agencies for a few years to strengthen the farmers. The farmers experienced positive changes after becoming part of FPOs, especially after receiving the new techniques. Despite the potential benefits, the FPOs faced challenges like a lack of capital and a low asset base; these FPOs also needed to pay tax and GST to the government as per the policy. They are not able to set up their procurement centers, and at the same time, they also need warehouse facilities [41]. The FPOs may also help export products to different countries to increase revenue; however, proper market linkage, firm foreign policy, and tax exceptions may yield profits for the farmers and the FPOs. The way out of these challenges is to find a better investment option for the farmers to facilitate modern technologies. However, the question is who will invest in landless and mortgage less farmers and at what cost [27].

6.1.3 FPO and agricultural Innovations System

When We explored the research further with the keywords "farmers; agriculture; management; adoption; systems; sustainability; food; market; networks; innovation; food; security; adaptation; politics; risk; knowledge; framework; information; model; and FPO", we explored only 554 results, and during the year 2024, only eighteen research articles were published. Moreover, only two articles talk about the innovation process in agriculture. In India, a substantial amount of food is wasted before it reaches the end users. Food Loss is a common challenge from the farmer's gate till it reaches the outlet routed via FPOs. This refers to the loss of nutritional and economic value of food in these gateways. Agricultural innovation systems, such as intelligent agriculture, community practice, institutional new policies, and business models, may help to revise the situation [46]. The FPOs may facilitate small cold chain infrastructure and agricultural innovation technology providers [44] for these farmers through their investment corridors, reducing food loss during the supply chain process. FPOs may invite government agencies to create a sustainable business model as these enhanced supply chain processes need huge investments and may be achieved by developing new policy frameworks [34].

6.1.4 FPO and Farmer's Empowerment

When We explored the research further with the keywords "collective action; producer organizations; determinants; performance; smallholders; agricultural cooperatives; participation; membership; impacts; technology; adoption; efficiency; market access; poverty; smallholder farmers and FPO", we explored only 286 results, and during the year 2024, only fourteen research articles were published. The role of FPOs is crucial in global platforms and exclusively in underdeveloped countries by giving voices to small farmers, decreasing transaction costs [18] and empowering the farmers [36]. FPOs can be a bridge for farmers by enhancing their production performances with enhanced technology and providing economies of scale by removing intermediaries. FPOs may take the legal shape of cooperatives, producer companies, societies or public trusts [21]

to buy cheaper raw materials and to ensure bulk selling with broad market access functions by acting as high-value agricultural market exports. When small farmers become part of any FPOs, they experience positive and significant impacts on net returns, return on investment and profit margin [15], [17].

7. Conclusion

The main objective of this work is to perform bibliometric analysis of scientific literature on "Farmer Producer Organization". The paper aims to identify which theme responds better to how much, who, what, where and how much research in FPOs is executed. The essential keywords are farmers and collective action, which form the base for the Farmers Producers Organization. The countries with the maximum number of citations are the USA, Germany, Netherlands, and the UK, with the highest average citations per year. The most critical journal on the "FPOs" theme worldwide is sustainability, rural studies, and food policies. Almost 90% of authors have substantial nexus to the University Of Wageningen and Florida. This opens avenues for collaboration and funding opportunities and enhances the quality of research. In the case of India, the authors are only affiliated with renowned and venerated organizations, i.e. ICAR (Indian Council of Agriculture Research). India has adequate no. SCP (single country publication) on "FPO" themes but trail behind in MCP (multiple country publication), hence weakening the collaboration index. The essential themes from bibliometric analysis are farmers, collective action and governance. Governance, sustainability, certification, and markets were Specific keywords that received very paltry attention. This can be the thrust areas of future research and sets new topic trends in research. It is high time India produced an Uber research paper on the abovementioned keywords in collaboration with leading institutes worldwide.

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7.3 Ethics Approval And Consent To Participate

The research work is the outcome of secondary data. Files were extracted from WOS to perform a Bibliometric study; hence, ethical committee approval is not applicable here.

7.4 Declaration Of Conflicting Interests:

The authors declare that there is no conflict of interest.

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